

BAUXITE AND ALUMINA

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Bauxite is a naturally occurring, heterogeneous material comprised primarily of one or more aluminum hydroxide minerals plus various mixtures of silica (SiO_2), iron oxide (Fe_2O_3), titania (TiO_2), aluminosilicates (clay, etc.), and other impurities in trace amounts. The principal aluminum hydroxide minerals found in varying proportions within bauxite are gibbsite [$\text{Al}(\text{OH})_3$] and the polymorphs, boehmite and diaspore [both $\text{AlO}(\text{OH})$].

Bauxite is typically classified according to its intended commercial application, such as abrasive, cement, chemical, metallurgical, and refractory. Of all bauxite mined, approximately 85% is converted to alumina (Al_2O_3) for the production of aluminum metal, and an additional 10% is converted to various forms of specialty aluminas for nonmetal uses. The remaining 5% is used directly for nonmetallurgical bauxite applications. The bulk of world bauxite production is used, therefore, as feed for the manufacture of alumina via a wet chemical caustic leach process known as the Bayer process. Most of the alumina produced from this refining process is smelted using the Hall-Héroult process to produce aluminum metal by electrolytic reduction in a molten bath of natural or synthetic cryolite (NaAlF_6).

Specifications for the nonmetallurgical grades of bauxite are more stringent than those for bauxite used to produce alumina and are based on the processing requirements and special properties required of their final commercial products. The natural chemical impurities that exist within these specialty-grade ores are not chemically removed by refining since the ores are used as direct feed for the production of their ultimate end products. Although global figures on nonmetallurgical bauxite production and consumption are not commonly available, the principal industrial end uses are considered to be in refractories and abrasives, followed by cement applications. In addition, the aluminum chemicals and steel industries also consume significant quantities of bauxite.

Twenty-two countries reported bauxite mine production in 2002, and total world production increased by 5% compared with that of 2001. Australia, Brazil, Guinea, and Jamaica accounted for about two-thirds of the total bauxite mined in 2002. The principal sources of nonmetallurgical-grade bauxite are limited to only a handful of countries: Abrasive grade is produced in Australia, China, Greece, Guinea, Guyana, and Italy; refractory grade, in Brazil, China, and Guyana (Russell, 1999, p. 49, 58).

Total reported world reserves of bauxite are sufficient to meet cumulative world primary aluminum metal demand well into the 21st century. Although bauxite reserves are unevenly distributed throughout the world, with approximately 90% in about a dozen countries, the sheer magnitude of these reserves (22 billion metric tons) is sufficient to ensure a readily accessible supply for the future (Plunkert, 2003).

U.S. production of alumina (calcined equivalent), derived almost exclusively from imported metallurgical-grade bauxite, was essentially unchanged compared with that of 2001. An estimated 91% of the alumina shipped by U.S. refineries went to domestic primary smelters for aluminum metal production. Consumption by the abrasives, chemicals, refractories, and specialties industries accounted for the remainder of U.S. alumina shipments.

World output of alumina increased 4% in 2002. The principal producing countries, in descending order of alumina output, were Australia, China, the United States, and Brazil. These countries accounted for almost 60% of the world's production; Australia alone accounted for about one-third of total world production.

Legislation and Government Programs

In October 2002, the Defense Logistics Agency (DLA) released its Annual Materials Plan (AMP) for the National Defense Stockpile (NDS) for fiscal year 2003 (October 1, 2002, to September 30, 2003). The 2003 AMP, including its subsequent revisions, provided for the sale of 2.03 million metric tons (Mt) (2 million long tons) of Jamaica type, metallurgical-grade bauxite. Also, as part of the plan, the DLA was authorized to dispose of 43,700 calcined metric tons (43,000 long calcined tons) of refractory-grade bauxite in fiscal year 2003 (Defense Logistics Agency, 2002). These were the maximum amounts recommended for disposal during the fiscal year, and the actual level of sales would depend upon prevailing market conditions.

At yearend 2002, the NDS uncommitted inventory for Jamaica type, metallurgical-grade bauxite was 1.71 Mt (1.68 million long tons). The NDS calcined refractory-grade bauxite inventory was 42,400 calcined tons (41,800 long calcined tons) (Defense Logistics Agency, 2003).

Production

Bauxite.—For many years, domestic mines have supplied less than 1% of the U.S. requirement for bauxite. Essentially all the domestic bauxite production is used in nonmetallurgical products, such as abrasives, chemicals, proppants, and refractories. Thus, the United States imports almost all the bauxite, especially the metallurgical grade, that it requires.

Alumina.—Kaiser Aluminum & Chemical Corp. announced that its Gramercy, LA, alumina refinery returned to full production in

2002 following an explosion at the facility more than 3 years ago. The reconstructed refinery has a capacity of 1.25 million metric tons per year (Mt/yr) (Kaiser Aluminum & Chemical Corp., 2003, p. 5).

St. Croix Renaissance Group LLP purchased the former St. Croix Alumina plant site from Alcoa Inc., which had announced the permanent closure of the refinery in 2001. St. Croix Renaissance is a partnership of Brownsfield Recovery Corporation, Energy Answers Corporation of Puerto Rico, and Myron Allick of St. Croix. The partnership announced plans to redevelop the 1,240-acre site to attract industrial and recreational businesses (Brownsfield Recovery Corporation, 2002§¹).

Consumption

Bauxite.—Total domestic consumption of bauxite increased by about 2% compared with that of 2001. In 2002, 93% of the bauxite consumed in the United States was refined to alumina (an estimated 2.1 metric tons (t) of dried bauxite was required to produce 1 t of alumina); the remaining 7% was consumed in nonmetallurgical applications (table 4). Domestic production and consumption data for bauxite and alumina were obtained by the U.S. Geological Survey from three voluntary surveys of U.S. operations. One of these surveys is “Bauxite Consumption,” sent to 44 operations, 30 of which responded, representing 99% of the bauxite consumed for uses other than cement listed in table 4.

In early 2002, Germany’s RHI AG announced that it wanted to sell all the companies included under its subsidiary RHI Refractories Holding Co. because of increasing asbestos litigation. In January, North American Refractories Co. (a subsidiary of RHI Refractories) announced that it had filed for reorganization under Chapter 11 of the U.S. Bankruptcy Code. In February, RHI Refractories announced that its three remaining businesses, A.P. Green Refractories Co., Global Industrial Technologies Inc., and Harbison-Walker Refractories Co., also filed for reorganization under Chapter 11 (Industrial Minerals, 2002d). In August, RHI Refractories changed its name to ANH Refractories Co. to establish an identity separate from that of its parent, RHI AG (ANH Refractories Co., 2002§). At yearend, all subsidiaries continued to operate under Chapter 11.

Alumina.—An estimated 91% of the alumina shipped by U.S. alumina plants went to domestic primary aluminum smelters for metal production. In 2002, 16 primary aluminum smelters consumed 5.54 Mt of alumina. Consumption in various forms by the abrasives, chemicals, refractories, and specialties industries accounted for the remainder of U.S. alumina use.

Prices

Most metallurgical-grade bauxite and alumina are purchased under long-term contracts. Contract terms for these commodities normally are not made public. Spot prices for metallurgical-grade alumina and specialty forms of bauxite and alumina for nonmetallurgical applications, however, are published in trade journals.

Industrial Minerals (2002c) quoted end-of-year prices for several types of imported refractory-grade bauxite from Brazil, China, and Guyana. The price range for bulk Brazilian refractory-grade bauxite was \$115 to \$130 per metric ton, free on board (f.o.b.) Brazil. The price quotes for Chinese refractory-grade bauxite, minimum 87% Al₂O₃ f.o.b. Chinese ports, were as follows: Shanxi, shaft, lump, \$65 to \$75 per ton; Shanxi rotary, lump, \$80 to \$88 per ton; and Guizhou, rotary, lump, \$80 to \$88 per ton. The price range for Guyanese refractory-grade bauxite was \$160 to \$170 per ton, f.o.b. barge, U.S. Gulf Coast.

The 2002 annual average values of U.S. imports of metallurgical-grade bauxite are listed in table 7. As shown in the table, the 2002 values were significantly lower than those of 2001.

The market or spot prices for alumina fluctuated during 2002 but ended the year at a slightly higher and narrower price range than at yearend 2001. According to Metal Bulletin, metallurgical-grade alumina spot prices on international markets began 2002 at \$130 to \$140 per ton. The price range reached a high for the year of \$157 to \$160 per ton at the end of May. By yearend, the price range had decreased to \$138 to \$143 per ton. Trade data released by the U.S. Census Bureau indicated that the average annual value of U.S. imports of calcined alumina was \$186 per ton, free alongside ship (f.a.s.) port of shipment, and \$197 per ton, cost, insurance, and freight (c.i.f.) U.S. ports.

Trade

In addition to the materials listed in tables 8-10, various specialty aluminum compounds were also traded. The compounds exported in 2002 included 6,720 t of aluminum sulfate; 13,100 t of aluminum chloride; 10,300 t of aluminum oxide abrasives; and 9,060 t of fluoride-based compounds of aluminum, including synthetic cryolite and aluminum fluoride. The compounds imported in 2002 included 5,210 t of aluminum sulfate; 1,300 t of aluminum chloride; 179,000 t of aluminum oxide abrasives; and 17,000 t of fluoride-based aluminum compounds.

World Review

In 2002, world production of bauxite increased 5% compared with that of 2001 (table 11). Mine production was reported in 22 countries, and total world production amounted to more than 144 Mt. The largest producers of bauxite, in decreasing order of tonnage mined, continued to be Australia, Guinea, Brazil, and Jamaica, accounting for about two-thirds of total world production.

¹References that include a section mark (§) are found in the Internet References Cited section.

World output of alumina increased 4% in 2002 compared with that of 2001 (table 12). The four principal producing countries, in order of quantity of alumina produced, were Australia, China, the United States, and Brazil. These countries accounted for almost 60% of the world's production; Australia alone accounted for about one-third.

Industry mergers.—Norsk Hydro ASA of Norway purchased VAW Aluminium AG from E.ON AG, the German utility group. The new company will be called Hydro Aluminium AS (Norsk Hydro ASA, 2003, p. 20). In addition to primary aluminum smelters and downstream fabrication facilities, the acquisition included a 50% interest in the 800,000-metric-ton-per-year (t/yr) Stade alumina refinery in Germany (CRU Alumina Monitor, 2002b). The acquisition of VAW made Norsk Hydro the third largest integrated aluminum company in the world, ranking behind Alcoa Inc. and Alcan Inc. (Platts Metals Week, 2002b).

Australia.—Alcoa and AlintaGas Ltd. signed a memorandum of understanding to jointly develop powerplants at Alcoa's alumina refineries in Western Australia. The energy co-generation plants would be developed on a staged basis to match growth in Western Australia's electricity requirements. Under the agreement, Alcoa would use all of the steam output from the co-generation plants in its alumina refineries, and Alinta would sell the electricity into the retail electricity market. Alcoa has three refineries in Western Australia: Kwinana with a capacity of 2 Mt/yr; Pinjarra, 3.4 Mt/yr; and Wagerup, 2.3 Mt/yr. The first powerplant was scheduled to be operational in 2004 (American Metal Market, 2002).

Shareholders approved the demerger of WMC Ltd. creating two new companies, WMC Resources Ltd. and Alumina Limited (Platts Metals Week, 2002c). WMC Resources Ltd. will include copper, nickel, and fertilizer assets, as well as exploration and development projects. Alumina Limited will hold WMC's 40% interest in Alcoa World Alumina & Chemicals (AWAC), the world's largest alumina producer. AWAC operates eight alumina refineries around the world with a total production capacity of 13.1 Mt/yr, about 25% of world production capacity (Alumina Limited, 2003§).

Brazil.—Vale do Rio Doce Alumínio S.A. (Aluvale), the aluminum arm of Companhia Vale do Rio Doce (CVRD), acquired the 12.6% interest in Alumina do Norte do Brasil S.A. (Alunorte) held by Mineração do Rio do Norte (MRN). The purchase increased Aluvale's interest in the alumina refinery to 57% (Platts Metals Week, 2002a). The other major interest is held by Norsk Hydro, 34% (Norsk Hydro ASA, 2003, p. 20).

Through Aluvale, CVRD also purchased a 64% interest in Mineração Vera Cruz S.A. (MVC) from the nonferrous conglomerate Paranapanema Group. With the purchase, Aluvale became the sole owner of MVC, which holds mining rights on 18 areas in the Paragominas region of Pará State containing an estimated 878 Mt of metallurgical-grade bauxite resources. These resources are located close to CVRD's existing bauxite resources and only 250 kilometers (km) from the Alunorte refinery (Mining Journal, 2002a).

Germany.—Pechiney acquired Alufin GmbH Tabularoxid, a producer of tabular alumina, which is used primarily in high-performance refractories. The Teutschenthal plant near Leipzig, Germany, has an annual production capacity of 18,000 t (Pechiney, 2002).

India.—Ashapura Minechem Ltd. entered the abrasive bauxite market through its acquisition of Bombay Minerals Ltd. Bombay Minerals, which owned a reported 50 Mt of bauxite reserves in western India, extracted about 200,000 to 250,000 t/yr of bauxite during the past 20 years. Ashapura also acquired Bombay Mineral's 60,000-t/yr bauxite calcination and grinding facility and announced plans to produce and export about 20,000 t of abrasive-grade calcined bauxite during 2002 (Industrial Minerals, 2002b).

Iran.—Iran Aluminium Co. (Iralco) reported that the first production line at its Jajarm alumina refinery had been completed, and that by yearend the plant was producing at the rate of 50,000 t/yr. The plant reportedly will use imported bauxite until March 2003 when locally sourced bauxite will become available. Upon completion, scheduled for yearend 2003, capacity was expected to reach 280,000 t/yr (Mining Journal, 2002b).

Ireland.—Glencore International AG announced a joint-venture agreement with E.ON Benelux Services to build a 140-megawatt Combined Heat and Power (CHP) plant at the Aughinish refinery site. The project will supply steam for calcination, as well as electricity for the refinery and the Irish electrical grid. Construction of the CHP plant was expected to be completed by early 2005 (Metal Bulletin, 2002).

Jamaica.—AWAC and the Government of Jamaica announced an agreement to invest \$115 million to expand the Jamalco alumina refinery in Clarendon, Jamaica. The expansion will increase capacity at the jointly owned (50/50) refinery by 25% to 1.25 Mt/yr. The Government of Jamaica also announced the removal of the 28-year-old levy on bauxite from Jamalco, effective in 2003 when the expansion is expected to be completed. It is anticipated that the removal of the levy along with the expansion would lower costs at the refinery by 30% (Alcoa Inc., 2002b).

Kaiser Aluminum & Chemical Corp. announced that its board of directors approved an expenditure of \$13.7 million at its 65%-owned Alpart alumina refinery to improve efficiency and to support a previously announced capacity expansion to 1.65 Mt/yr. The expenditure covers two separate projects, both of which are scheduled for completion by yearend 2003: A new dual-feed system will enable the facility to more efficiently process different grades of bauxite, and a new cooling system will improve alumina quality. The total cost of the two projects is estimated at \$21 million, 35% of which is funded by Alpart's minority-interest owner, Hydro Aluminium AS (Kaiser Aluminum & Chemical Corp., 2002).

Russia.—Siberian-Urals Aluminium Co. (SUAL) completed a new 158-km rail track to the Sredne-Timan bauxite mine in the Komi Republic. Prior to the opening, bauxite ore had to be transported by road. Eventually, the rail track will carry 8 Mt/yr of cargo, including other mined products and timber. SUAL estimates that bauxite production at Sredne-Timan could reach 2.55 Mt of bauxite in 2005 compared with 700,000 t in 2001. The Sredne-Timan field reportedly has proven bauxite reserves of 250 Mt of bauxite ore that is amenable to open pit extraction (Interfax Mining & Metals Report, 2002b).

Since 1997, SUAL has invested more than \$100 million in the Sredne-Timan bauxite complex and has announced plans to build an alumina refinery and smelter at the site. SUAL signed an agreement with Hatch Associates to conduct a prefeasibility study for the proposed \$2 billion complex. According to SUAL, the Hatch report suggested that SUAL build a 330,000 t/yr smelter and a 1.4 Mt/yr

alumina refinery. An in-depth feasibility study is scheduled to be conducted in 2003 (Cooper, 2002).

SUAL also announced its decision to close Yuzhno-Uralskiye Boksitoviye Rudniki (South Urals Bauxite Mines, YUBR) at yearend. Depletion of reserves and high operating costs were cited as reasons for the closure. The mines have been operating since 1936. SUAL expected production from the Sredne-Timan mines to offset the loss of output from YUBR (Interfax Mining & Metals Report, 2002c).

SUAL and Sevzapprom Management Co. have agreed to merge their aluminum assets under SUAL. Sevzapprom manages the Volgograd aluminum smelter, Metallurg JSC's Volkhov aluminum smelter, and Pikalyovsky Glinozyom alumina refinery. Upon completion of the merger, SUAL will have the capacity to produce about 2 Mt/yr of alumina and 850,000 t/yr of metal. Sevzapprom will control the companies' non-aluminum assets, the Syas and Vyborg paper mills (Interfax Mining & Metals Report, 2002a).

Suriname.—Alcoa and BHP Billiton Plc, which have joint interests in alumina refining and bauxite mining operations in Suriname, signed a Letter of Intent “formalizing cooperation on various opportunities in the country.” The letter covers the continuation of mining and refining bauxite in eastern Suriname beyond the joint venture expiration date of 2006, the preparation of an engineering study for the expansion of the 2-Mt/yr Paranam refinery, and the exploration of mining opportunities in western Suriname. Separately, Alcoa will explore the feasibility of building a hydroelectric powerplant in western Suriname for future development needs. Subject to final agreement as well as governmental and other approvals, construction of the 250,000-t/yr Paranam refinery expansion could begin in 2003 (Alcoa Inc., 2002a).

United Kingdom.—Following its decision to withdraw from the specialty alumina chemical business in Europe and the failure to find a buyer for its facility, Alcan Inc. announced the closure of its Burntisland facility in Scotland (Alcan Inc., 2002). The 100,000-t/yr facility produced specialty alumina trihydrate (ATH) and a range of alpha, calcined, milled, and reactive aluminas that are used in a range of industrial products such as flame retardants, paper, chemicals, ceramics, and refractories (Industrial Minerals, 2002a).

Vietnam.—Vietnam National Mineral Corporation (Vimico) announced plans to build a 300,000-t/yr alumina refinery and a 72,000-t/yr smelter in Lam Dong Province (CRU Alumina Monitor, 2002a). Pechiney reportedly will conduct the feasibility study for the new complex (Mining Journal, 2002c).

Outlook

Identified world bauxite reserves are sufficient to meet cumulative world demand well into the 21st century. Considering the probability of discovering additional bauxite deposits plus the added possibility of employing lower grade bauxite occurrences and various alternative sources of alumina, world resources of aluminum remain adequate to satisfy demand for the foreseeable future.

World aluminum supply probably will continue to outstrip demand. Although many industry observers believe that there could be significant growth in aluminum demand over the next few years, supply expansions, especially in China, were expected to more than meet the increase in demand.

The world alumina market was fairly tight during the first half of 2003. Increased demand by aluminum smelters was being met by refinery expansions and the restart of previously idled capacity.

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TABLE 1
SALIENT BAUXITE STATISTICS¹

(Thousand metric tons)

	1998	1999	2000	2001	2002
United States:					
Production, crude ore (dry equivalent)	NA	NA	NA	NA	NA
Value	NA	NA	NA	NA	NA
Exports (as shipped):					
Crude and dried	83	115	133	67	27
Calcined	16	34	9	14	15
Imports for consumption (as shipped):					
Crude and dried	11,000	9,890	8,550	8,300	7,340
Calcined	393	299	310	242	237
Consumption (dry equivalent)	12,700	11,700	10,800	9,770 ^r	9,970
World, production	123,000	129,000 ^r	136,000 ^r	137,000 ^r	144,000 ^e

^eEstimated. ^rRevised. NA Not available.

¹Data are rounded to no more than three significant digits.

TABLE 2
ESTIMATED PRODUCTION AND SHIPMENTS OF ALUMINA IN THE UNITED STATES¹

(Thousand metric tons)

Year	Calcined alumina	Other alumina ²	Total	
			As produced or shipped ³	Calcined equivalent
Production:				
2001	3,930	608	4,540	4,340
2002	3,930	605	4,540	4,340
Shipments:				
2001	4,030	617	4,650	4,440
2002	3,900	610	4,510	4,310

¹Data are rounded to no more than three significant digits.

²Trihydrate, activated, tabular, and other aluminas. Excludes calcium and sodium aluminates.

³Includes only the end product if one type of alumina was produced and used to make another type of alumina.

TABLE 3
CAPACITIES OF DOMESTIC ALUMINA PLANTS, DECEMBER 31^{1,2}

(Thousand metric tons per year)

Company and plant	2001	2002
Alcoa Inc.:		
Point Comfort, TX.	2,300	2,300
St. Croix, VI ³	--	--
Total	2,300	2,300
BPU Reynolds, Inc., Corpus Christi, TX	1,600	1,600
Kaiser Aluminum & Chemical Corp., Gramercy, LA	1,250	1,250
Ormet Corp., Burnside, LA	600	600
Grand total	5,750	5,750

-- Zero.

¹Capacity may vary depending on the bauxite used.

²Data are rounded to no more than three significant digits; may not add to totals shown.

³Permanently shutdown in 2001.

TABLE 4
U.S. CONSUMPTION OF BAUXITE, BY INDUSTRY¹

(Thousand metric tons, dry equivalent)

Industry	2001	2002
Abrasive	61	52
Alumina	9,010	9,290
Cement ²	302 ^r	324
Chemical	W	W
Refractory	175	115
Other ³	222	183
Total	9,770 ^r	9,970

^rRevised. W Withheld to avoid disclosing company proprietary data, included with "Other."

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Data from the D15-Cement Annual Survey Form, U.S. Geological Survey Form 9-4041-A.

³Includes municipal water works, oil, and steel and ferroalloys.

TABLE 5
STOCKS OF BAUXITE IN THE UNITED STATES, DECEMBER 31^{1, 2}

(Thousand metric tons, dry equivalent)

Sector	2001	2002
Producers, processors, consumers	1,740 ^r	1,260
Government	2,070	1,770
Total	3,810 ^r	3,030

^rRevised.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Domestic and foreign bauxite; crude, dried, calcined, activated, all grades.

TABLE 6
STOCKS OF ALUMINA IN THE UNITED STATES, DECEMBER 31^{1, 2}

(Thousand metric tons, calcined equivalent)

Sector	2001	2002
Producers	308	337
Primary aluminum plants	1,100	1,070
Total	1,400	1,410

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Excludes consumers stocks other than those at primary aluminum plants.

TABLE 7
AVERAGE VALUE OF U.S. IMPORTS OF CRUDE AND DRIED BAUXITE¹

(Per metric ton)

Country	2001		2002	
	Port of shipment (f.a.s.)	Delivered to U.S. ports (c.i.f.)	Port of shipment (f.a.s.)	Delivered to U.S. ports (c.i.f.)
Australia	\$13.35	\$26.97	\$12.82	\$23.67
Brazil	25.13	32.23	22.85	29.19
Guinea	26.05	32.71	22.52	28.31
Guyana	29.02	38.79	26.14	34.54
Jamaica	19.37	21.89	17.50	19.51
Weighted average	23.27	29.09	20.35	24.66

¹Computed from quantity and value data reported to U.S. Customs Service and compiled by the U.S. Census Bureau, Department of Commerce. Not adjusted for moisture content of bauxite or differences in methods used by importers to determine value of individual shipments.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF BAUXITE, CRUDE AND DRIED, BY COUNTRY¹

(Thousand metric tons)

Country	2001	2002
Imports:		
Australia	175	113
Brazil	968	212
Guinea	2,620	2,200
Guyana	716	692
Jamaica ²	3,620	4,070
Other	207	57
Total	8,300	7,340
Exports:		
Canada	61	26
Mexico	(3)	(3)
Other	5	1
Total	67	27

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Dry equivalent of shipments to the United States.

³Less than 1/2 unit.

NOTE: Total U.S. imports of crude and dried bauxite as reported by the U.S. Census Bureau were as follows: 2001 – 7,430,000 tons and 2002 – 6,420,000 tons.

Sources: U.S. Census Bureau and the Jamaica Bauxite Institute.

TABLE 9
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF CALCINED BAUXITE, BY COUNTRY¹

(Thousand metric tons and thousand dollars)

Country	2001				2002			
	Refractory grade		Other grade		Refractory grade		Other grade	
	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²	Quantity	Value ²
Imports:								
Australia	--	--	61	\$5,790	--	--	47	\$4,290
Brazil	10	\$1,130	2	148	5	\$504	5	710
China	59	5,010	75	6,220	97	7,560	67	4,970
Guyana	18	2,100	3	477	8	868	8	1,290
Other	4	310	11	365	(3)	10	(3)	26
Total	90	8,550	152	13,000	110	8,950	127	11,300
Exports:								
Canada	3	558	3	263	2	396	7	533
Japan	(3)	196	(3)	15	--	--	(3)	85
Mexico	3	446	(3)	43	5	501	(3)	34
Other	2	1,250	2	386	1	361	1	213
Total	9	2,450	5	707	7	1,260	8	865

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Value at foreign port of shipment as reported to U.S. Customs Service.

³Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 10
U.S. IMPORTS FOR CONSUMPTION AND EXPORTS OF ALUMINA, BY COUNTRY¹

(Thousand metric tons, calcined equivalent, and thousand dollars)

Country	2001		2002	
	Quantity	Value ²	Quantity	Value ²
Imports:				
Australia	1,810	\$325,000	1,740	\$271,000
Brazil	165	36,000	65	12,700
Canada	84	53,300	90	58,000
France	12	18,400	11	15,800
Germany	41	60,600	40	68,500
India	3	1,380	(3)	239
Jamaica	278	51,900	293	49,700
Japan	6	12,300	6	15,200
Suriname	654	118,000	704	108,000
Venezuela	1	186	(3)	81
Other	48	28,200	58	33,300
Total	3,100	704,000	3,010	633,000
Exports:				
Brazil	1	3,660	1	2,700
Canada	1,100	248,000	1,110	202,000
China	2	3,930	2	1,720
Finland	(3)	196	(3)	372
Mexico	35	19,600	68	25,000
Netherlands	2	5,260	3	4,870
Norway	(3)	149	32	4,570
Russia	(3)	501	(3)	179
Sweden	1	1,140	1	1,350
Other	103	141,000	55	119,000
Total	1,250	424,000	1,270	362,000

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Value at foreign port of shipment as reported to U.S. Customs Service.

³Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 11
BAUXITE: WORLD PRODUCTION, BY COUNTRY^{1,2}

(Thousand metric tons)

Country	1998	1999	2000	2001	2002 ^c
Australia	44,553	48,416	53,802	53,285	54,024 ³
Bosnia and Herzegovina ^c	75	75	75	75	75
Brazil	11,961	14,372 ^r	14,290 ^r	13,178 ^r	13,900
China ^c	8,200	8,500	9,000	9,800 ^r	12,000
Ghana	341 ^r	355	504	678 ^r	684 ³
Greece	1,823	1,883	1,991	2,052	2,492 ³
Guinea ⁴	15,570	15,590	15,700	15,700 ^c	15,700
Guyana ⁴	2,267	2,359	2,471	1,985	2,000
Hungary	1,138	935	1,047	1,000	1,000
India	6,102	6,712	7,562	7,864 ^r	9,274 ³
Indonesia	1,056	1,116	1,151	1,237	1,283 ³
Iran	336 ^r	912 ^r	400 ^r	400 ^{r, c}	400
Jamaica ^{4, 5}	12,646	11,688	11,127	12,370 ^r	13,119 ³
Kazakhstan	3,437	3,607	3,730	3,685 ^r	4,377 ³
Malaysia	160	224	123	64	40 ³
Mozambique	6	8	8	9 ^r	9
Pakistan	5	11	9	9 ^e	8
Romania	162	--	--	--	--
Russia ^c	3,450	3,750	4,200	4,000	3,800
Serbia and Montenegro	226	500	630	610	612
Suriname	3,931 ^r	3,714 ^r	3,610	4,512	4,500
Turkey ⁶	458	208	459	242	250
United States	NA	NA	NA	NA	NA
Venezuela	4,826	4,166	4,361	4,526 ^r	5,000
Total	123,000	129,000 ^r	136,000 ^r	137,000 ^r	144,000

^cEstimated. ^rRevised. NA Not available. -- Zero.

¹World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Table includes data available through July 25, 2003.

³Reported figure.

⁴Dry bauxite equivalent of crude ore.

⁵Bauxite processed for conversion to alumina in Jamaica plus kiln-dried ore prepared for export.

⁶Public-sector production only.

TABLE 12
ALUMINA: WORLD PRODUCTION, BY COUNTRY^{1, 2, 3}

(Thousand metric tons)

Country	1998	1999	2000	2001	2002 ^e
Australia	13,853	14,532	15,037	16,271	16,382 ⁴
Azerbaijan	(5)	76	63 ^r	95	63 ⁴
Bosnia and Herzegovina ^c	50	50	50	50 ⁴	50
Brazil	3,322	3,515	3,754	3,520 ^r	3,750
Canada	1,229	1,233	1,023	1,036	1,200
China ^e	3,330	3,840	4,330	4,650 ^r	5,450
France ^e	450	400	200 ⁴	150	150
Germany ^e	600	583 ⁴	700	100	100
Greece	625 ^e	626	667	660 ^e	660
Guinea	500	568	541	550 ^e	550
Hungary	138	145	150 ^e	150 ^e	150
India ^e	1,890	2,080	2,280	2,400	2,500
Ireland ^e	1,200	1,200	1,200	1,100	1,100
Italy	930	973	950 ^e	500 ^e	500
Jamaica	3,440	3,570	3,600	3,542	3,631 ⁴
Japan ⁶	359	335	369	331 ^r	340
Kazakhstan	1,085	1,158	1,217	1,231 ^r	1,386 ⁴
Romania	250	277	417	400 ^e	400
Russia	2,465	2,657	2,850 ^e	3,046 ^r	3,131 ⁴
Serbia and Montenegro	153	156	186 ^r	185 ^r	200
Slovakia ^e	100	100	110	110 ^r	110
Slovenia ^e	70	70	70	34	30
Spain ^{e, 7}	1,100	1,200	1,200	1,100	1,100
Suriname ^e	1,600	--	-- ⁴	--	--
Turkey	157	159	155	100 ^e	100
Ukraine	1,291	1,230	1,360	1,343 ^r	1,351 ⁴
United Kingdom	96	90	80 ^e	90 ^e	90
United States	5,650	5,140	4,790	4,340	4,340 ⁴
Venezuela	1,553	1,469	1,755	1,833 ^r	2,100
Total	47,500	47,400	49,100 ^r	48,900 ^r	50,900

^eEstimated. ^rRevised. -- Zero.

¹Figures represent calcined alumina or the total of calcined alumina plus the calcined equivalent of hydrate when available; exceptions, if known, are noted.

²World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

³Table includes data available through July 25, 2003.

⁴Reported figure.

⁵Production sharply curtailed or ceased.

⁶Data represented are for alumina used principally for specialty applications. Information on aluminum hydrate for all uses is not adequate to formulate estimates of production levels. Production of aluminum hydroxide, in metric tons: 1998--737,582; 1999--736,591; 2000--781,690; 2001--739,098 (revised); and 2002--740,000 (estimated).

⁷Hydrate.